Coulomb excitation of $^{74-80}$Zn (N=50): probing the validity of shell-model descriptions around ^{78}Ni

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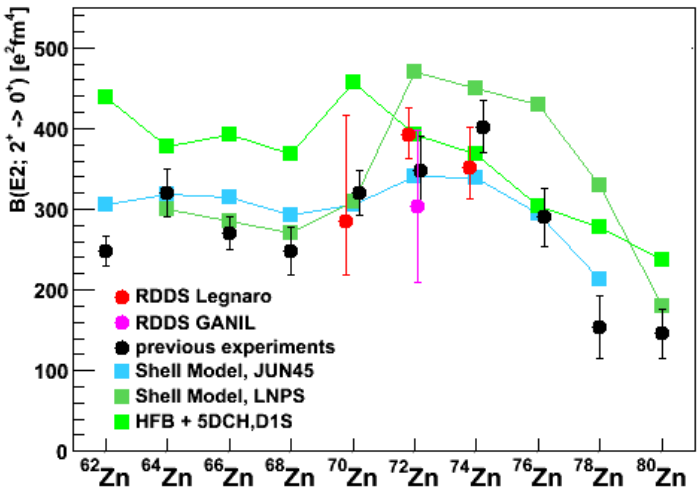
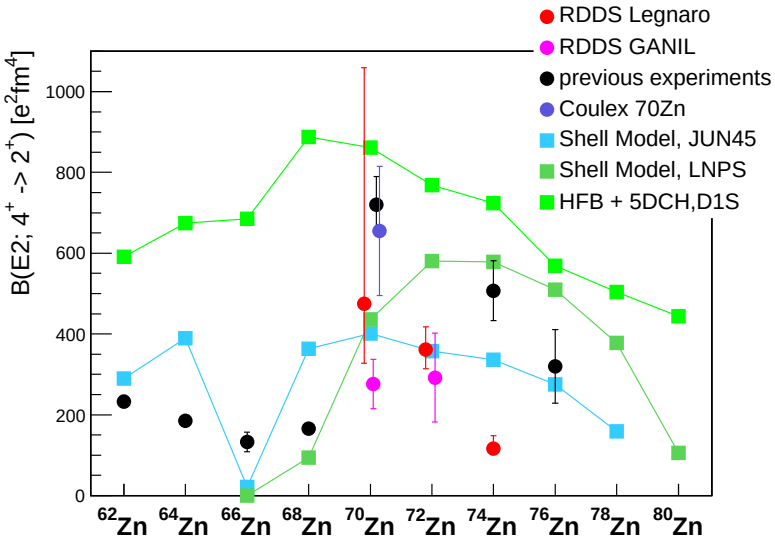
IS 557: Motivation

J. Van. de Walle, PRL. 99 (2007) 142501
C. Louchart, PRC 87 (2013) 054302
I. Celikovic, to be published

- transition probabilities in neutron-rich Zn nuclei are a good test of shell model around ^{78}Ni
- lifetimes for the 2^+ states consistent and in agreement with model predictions
- large discrepancies for 4^+ both on experimental and theoretical side

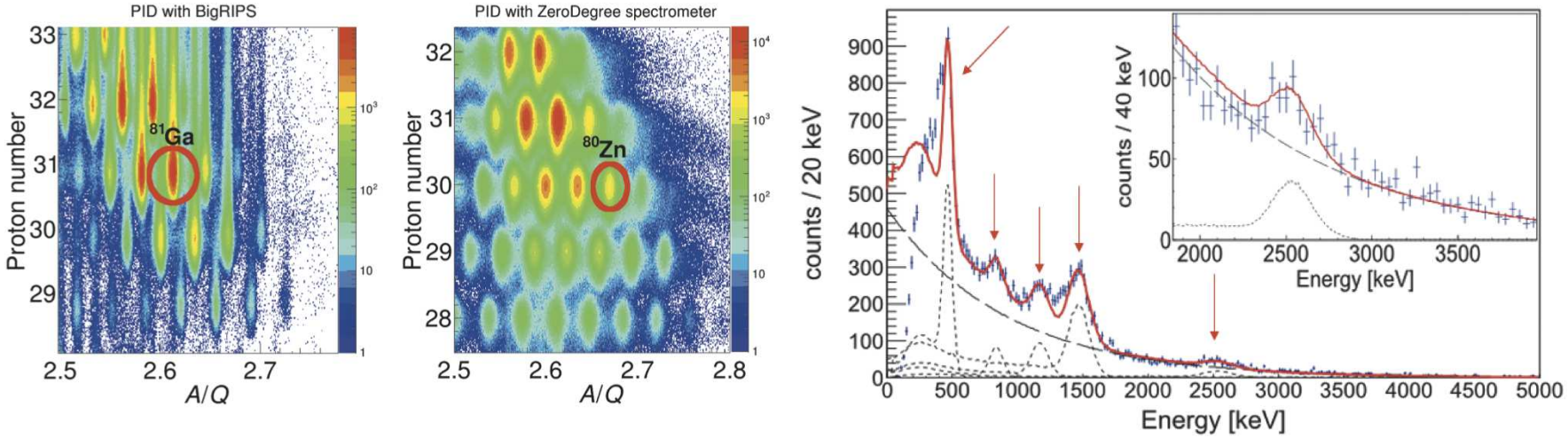




- need to remeasure precisely transition probabilities beyond 2^+ in $^{74-80}$Zn

What has been measured elsewhere?

- identification of the 4^+ state in ^{80}Zn at RIKEN
  - ^{9}Be(^{81}Ga,^{80}Zn) knockout at 345 MeV/A
  - gamma rays measured by DALI2 NaI array

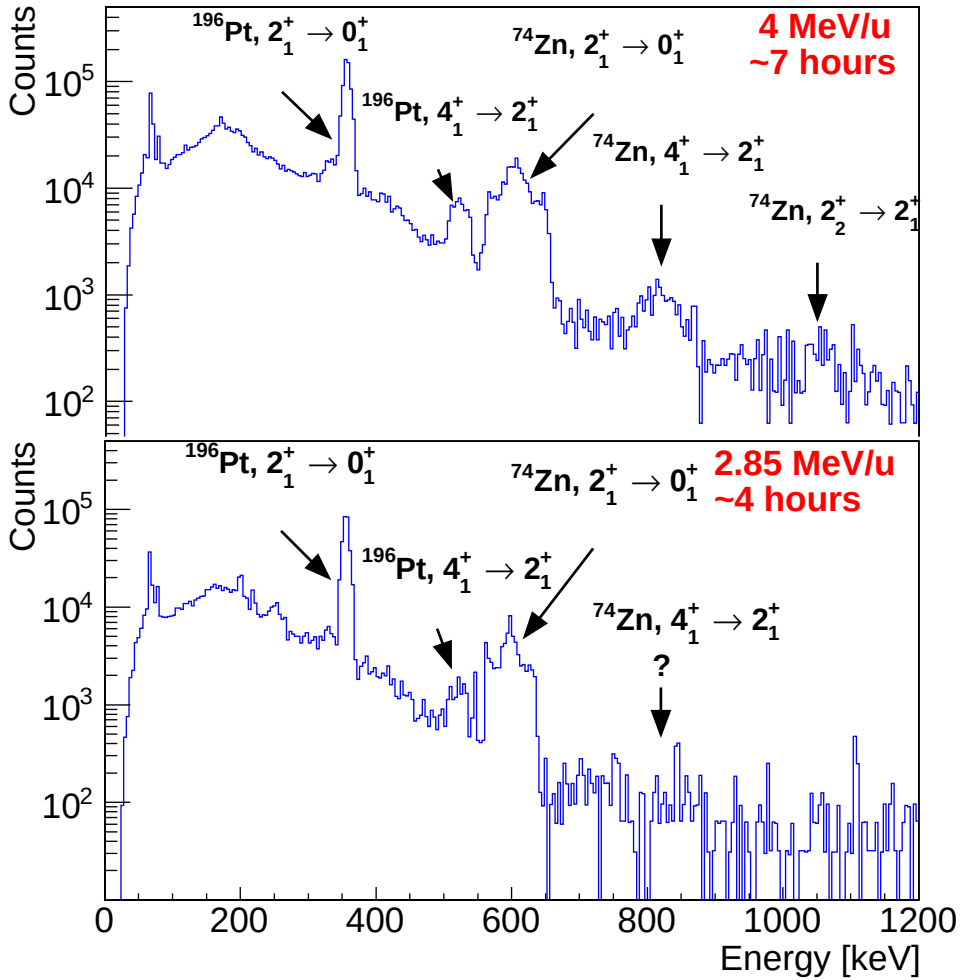


Y. Shiga, RIKEN Accel. Prog. Rep. 47 (2014)

- $4^+ \rightarrow 2^+$ identified at 450(30) keV
  (much better precision expected with MINIBALL!!)

IS 557: the first HIE-ISOLDE experiment

- clear increase in population of 4^+ and 2_2^+ at 4 MeV/A
- only ^{74,76}Zn measured (limited operation hours of HIE-ISOLDE)



IS 557: experimental requirements

- we are mostly interested in 4^+ states: they will all be populated in multi-step processes $\rightarrow$ large scattering angles, heavy target and high beam energy preferred
- we need to cover LAB scattering angles between $\sim$25 and 54 degrees, lower angles are not crucial (mostly one-step process)
- intensities: ^{78}Zn: 10^5 pps, ^{80}Zn: 10^4 pps
  (like in the proposal, confirmed by the ^{74,76}Zn run in 2015)
- RILIS for selective ionisation of Zn to reduce Rb and Ga contamination
- neutron converter needed for ^{78}Zn, quartz transfer line for ^{80}Zn
- beam energies reduced as compared to the proposal: 300-310 MeV for $^{74-78}$Zn ($\sim$ 4.0 MeV/A), 340 MeV for ^{80}Zn ($\sim$ 4.3 MeV/A)
- 12 shifts for ^{78}Zn, 12 shifts for ^{80}Zn (initial request)
  + 1 shift of ^{74}Zn or ^{76}Zn needed for cross check